1   **Use of Job Tickets to Secure Resource Access**

2   **Technical Field**

3   The technical field is integration and control of services in a networked environment.

4   **Background**

5   Services may be provided by one or more operating units in a computer-based network.

6   Users of the network may generate specific tasks and send the tasks into the network to be

7   assigned to one of the operating units. For example, a user at a computer terminal may generate

8   a printing order using a printer driver installed on the terminal. The printer driver is used to control

9   the printing request. In another example, a user at a computer terminal may generate a printing

10   order and send the printing order into a computer network so that the printing order is completed

11   by a printing service. The printing order may be related to a company brochure. The printing order

12   may contain unique requirements such as paper type, font size, layout, graphics, color, and other

13   requirements. The user may specify that a specific printing service, such as Kinkos, prepare the

14   company brochure. Alternatively, the computer network may include programs that suggest

15   printing services to the user.

16   To control the printing job, the user's computer terminal may generate a job ticket. The

17   job ticket includes the requirements, such as the requirements listed above, and an identification of

18   the specific job that allows the job status to be tracked through the computer network.

19   Use of the job ticket allows printing and similar services to be allocated to those resources

20   (i.e., the operating units) that are best suited to completing the services. Unfortunately, current

21   computer systems do not allow access to the wide variety of services existing in networked

22   computer systems, such as the Internet. In addition, current systems require users to have some

23   knowledge of the existing resources, and may require users to include applicable programming to

24   communicate with the services. Furthermore, current systems do not allow a job request to be split

25   among several processors. As a result, completion of the job request may take longer than

26   necessary, and may not be completed in the most efficient, lowest-cost manner. Finally, current

27   systems do no provide adequate security for job tickets.

1   **Summary**

2   To overcome these and other problems related to use of a job ticket, a method and an
3   apparatus allow a client to manage job attributes and processes using an electronic service center.
4   The service center includes a job ticket service that allows access and modification of a job ticket
5   by multiple users on a network. The method and apparatus use a network-accessible job ticket
6   to relate to a specific job or content. The job ticket may be an object, such as an XML object,
7   comprising routines and data. The content may be stored on the network and may be accessed
8   by multiple job tickets. Storage and management of the job ticket are transparent to the user. The
9   job ticket is stored in a common location in the network. The job ticket remains in the same
10   location in the network, and users access only that portion of the job ticket required to complete
11   a designated process. Security measures may be added to limit access to those users designated
12   as being allowed to access the job ticket and the job file. The job ticket may include a service ID
13   that relates the job ticket back to the originating job ticket service. In this way, a user who acquires
14   all or part of the job ticket can refer back to the originating job ticket service (and the original, or
15   as-modified, job ticket) to verify any changes and to ensure that the job ticket being accessed is
16   up-to-date. The job ticket also includes a job ID to refer the job ticket to a specific job.

17   The service center is coupled through a communications network to a front end service.
18   The front end service allows a user to generate a service or job request. The communications
19   network may be the Internet, or a local area network, for example.

20   The service center includes a service bus, to which are coupled a job store, the job ticket
21   service, and a work flow controller. Also coupled to the service center are one or more processors
22   that may be controlled to complete processes and tasks defined in the job tickets.

23   The job ticket service may generate and store the job tickets. Job content (e.g., a PDF file)
24   is stored in the job store. With this structure, the user does not have to manage storage of the job
25   content or to know which job store holds the job content. The job ticket service controls access
26   to the job tickets, and, through the use of the job tickets, also controls access to job content in the
27   job store, or elsewhere in the network. The job ticket service may create a reference to the job
28   ticket, and may use the reference to control access to the job ticket.

29   A job ticket service center may include several features to provide security and to control
30   access to the job ticket. In an embodiment, the job ticket service may employ branch locking. In

1   an alternate embodiment, servers may be used to authorize and authenticate a processor. An

2   authentication server receives authentication information from a processor and an authorization

3   server uses the information to check authorization functionality. The authorization or access rights

4   of the processor may be carried as a part of the job ticket. Using the above-described features,

5   the service center may provide trusted authentication information about the processor to the

6   authorization server, and the authorization server then performs its authority check functions using

7   this information.

8   In an embodiment, the job ticket may be signed with an industry standard public message

9   digest (MD) signature, and may be protected by a public key encryption system. Hence, any entity

10   that has the public key may validate the job ticket without having to communicate with the

11   authentication server. These features reduce communication between distributed server

12   applications. The features also allow the job ticket to be passed from one processor to another

13   processor, maintaining security, without communicating with the service center.

14   In an embodiment, when a processor modifies a branch, the processor accesses the job

15   ticket service to update the job ticket. The modified job ticket may then be signed before being

16   passed to the next processor.

17   In yet another alternative embodiment, the job ticket holds authentication/access data,

18   allowing controlled access to the job ticket. Resources may be protected by passwords and other

19   mechanisms. Access to the job ticket may be similarly protected. Furthermore, processors with

20   access authorization may have such access authorization invoked by listing the processors in the

21   job ticket. The listing may be effectuated by recording a network address for the processors, for

22   example. The network address may be incorporated in bid information recorded in the job ticket.

23   **Description of the Drawings**

24   The detailed description will refer to the following figures in which like numerals refer to like

25   items, and in which:

26   Figure 1 is a block diagram showing a prior art use of a job ticket;

27   Figure 2 is a tree diagram showing the processes in an example job ticket;

28   Figure 3 is a block diagram of a digital image work flow network;

29   Figure 4 is a block diagram of a service center used with the network of Figure 3;

30   Figures 5A-5D illustrate an exemplary job ticket;

1   Figure 6 is a diagram of functions controlled by a job ticket service;

2   Figure 7 is a diagram showing access functions controlled by the job ticket service;

3   Figure 8 is a block diagram illustrating additional control features of the job ticket service;

4   Figure 9 is a flow chart illustrating one of the processes controlled by the job ticket service;

5   and

6   Figures 10-15 are flow charts showing sub-processes in the overall process illustrated in

7   Figure 9.

8   **Detailed Description**

9   Figure 1 is a block diagram showing a prior art application of a job ticket service. Job

10   tickets are often associated with a printing standard, the job definition format (JDF). The JDF is

11   described in detail in JDF Specification Draft Spiral 4.0, available at www.hp_opensource.com,

12   which is hereby incorporated by reference. In Figure 1, a user 1 generates a job request and sends

13   the job request through a portal 4 to a processor 5. The job request may include a job ticket data

14   file 2 and a content file 3. The user 1 may be a computer terminal in a networked computer system

15   and the processor 5 may be a networked printer. The job request may involve printing a

16   document. The document may be represented by the content 3, which is a digital representation

17   of text and images to be printed. The intended format of the printed document may be described

18   in the job ticket file 2, which is simply a digital file that specifies how the printer is to print the

19   document. For example, the job ticket file 2 may require that the document be printed on back-to-

20   back pages.

21   In a specific application, the functions of the job ticket file 2 may be carried out by a printer

22   driver. The printer driver encodes control data related to printing the document, and sends the

23   control data and the content 3 to the printer (i.e., the processor 5). The printer accesses the control

24   data and the content 3 to print the document.

25   While the application shown in Figure 1 works well to print a document, the application has

26   many drawbacks. In particular, if multiple processors are involved in producing the document,

27   each such processor will require access to the job ticket file 2. This access brings problems related

28   to security, modification control and workflow control. For example, each processor requiring

29   access to the job ticket file 2 may have to wait on processing until a prior processor has completed

1   use of the job ticket file 2. Thus, the prior art application may result in unwanted delays in

2   completing the job request.

3   Prior art applications of job ticket services also suffer because the user may not know

4   anything about the processors, including capabilities and availabilities of the processors, or even if

5   the processors exist. Thus, the user may not know which portal to use to connect to a specific

6   processor.

7   These and other problems are solved by a method and an apparatus that controls access

8   to a job ticket and associated content through use of a job ticket service. The job ticket service

9   includes mechanisms that arbitrate access to the job ticket among multiple users of the job ticket,

10   limit access to the job ticket by incorporating security features, and ensure modifications made by

11   one processor or user are reflected in the job ticket and the content. In effect, the apparatus

12   includes a generic database that couples input data from clients as job requests with output services

13   such as processors that perform tasks or processes to complete the job requests. The database

14   may have the features of a generic XML database in that it is extensible, and in that the clients need

15   not have any knowledge of the individual processes to be performed, or the internal programming

16   requirements of the processors. Thus, the clients may submit job requests to a service center that

17   will ensure that an appropriate processor or processors are assigned to complete the job request.

18   Before describing the apparatus and method in detail, a review of a job ticket is provided.

19   Figure 2 is a node-tree diagram (or simply a node tree) 10 that illustrates processes defined in a

20   job ticket for printing a brochure. The brochure may be printed on a commercial press, and may

21   use digital content to generate plates for printing the brochure. Within the node tree 10, the nodes

22   specify a product, process, or group of processes. Each node may modify, consume or create

23   resources. Each node may contain further nested nodes, or sub-nodes. The arrangement of nodes

24   and sub-nodes may be likened to a tree, and each node and sub-node may be referred to as a

25   branch. A brochure node 11 defines the features and parameters of the brochure. A cover node

26   12 defines the parameters for producing the brochure cover. Inside pages node 13 includes the

27   parameters to produce the inside pages. The inside pages node 13 is shown with several sub-

28   nodes, including a sub-node 14 for digital plate making. The digital plate making sub-node 14 itself

29   includes two additional sub-nodes, a ripping sub-node 16 and a plate making sub-node 18.

1   Each of the nodes and sub-nodes shown in Figure 2 has associated with it input resources

2   and at least one output resource. A resource may be described by parameters or logical entities.

3   The resource may be a physical entity such as a component, a handling resource, or a consumable.

4   A component resource may be the output of a node or sub-node, such as a printed sheets. A

5   handling resource is used during a process, but is not consumed by the process. A consumable

6   resource may be partly or wholly consumed by the process. Examples of consumable resources

7   include inks, plates, and glue. Other resources may be a digital file or representation of a physical

8   object. For example, the ripping sub-node 16 may include as input resources a run list, media, RIP

9   parameters, and layout. The run list resource describes the pages, including the files in which the

10   pages occur, and which pages are to be used. The media resource describes the media that will

11   be used to make plates, and is needed to describe the dimensions of the media. The RIP

12   parameters resource describes all device-specific parameters of the ripping process. The layout

13   resource describes placement of source pages onto the plates, and eventually onto press sheets.

14   As an output resource, the ripping sub-node 16 may provide ripped flats. Other resources include

15   parameter resources, which define the details of processes, as well as other non-physical computer

16   files used by a process.

17   The node tree 10 shown in Figure 2 is intended to apply to printing a document. However,

18   node-tree diagrams may be used to represent job tickets for other services besides printing. For

19   example, a job ticket may be used for data processing, image processing, creating and maintaining

20   a database, electronic publishing, e-mail, and various e-commerce services. Moreover, the job

21   ticket may be used to allow different e-commerce services to interact with each other.

22   Figure 3 is a block diagram of a digital imaging work flow (DIW) network 20 that

23   incorporates a service center and a job ticket service to control tasks submitted by clients. The

24   service center may operate as a single portal through which the clients connect to one or more e-

25   services including e-mail, e-commerce and online shopping, e-printing, and data services, including

26   database searching and database construction, population and maintenance. In an alternative

27   embodiment, the service center may comprise multiple portals, with each of the multiple portals

28   being dedicated to a specific e-service, or being provided to increase bandwidth. Using a single

29   portal, such as the service center, allows the clients to select from a wide variety of e-services, such

30   as those noted above, without requiring the clients to have any prior knowledge of the e-services.

1   The service center may include components that receive information in the form of job

2   requests, and using the information, create a job ticket that specifies tasks and resources. The job

3   ticket may be stored in a job ticket service, and notices may be posted to indicate when a job ticket

4   is available. Processors coupled to the service center may bid on completion of the job ticket, and

5   the service center may include a bidding service that evaluates bids. The service center may select

6   one or more processors to assign to the job ticket based on client-supplied criteria, or based on

7   a set of standard criteria, including industry standard criteria. The service center may provide

8   mechanisms to control access to the job ticket, or to portions (branches) of the job ticket. The

9   mechanisms include branch locking, and authorization and authentication servers that use public key

10   encryption, or similar processes.

11   The service center may include hardware components such as servers, computers, central

12   processing units, communications interfaces, and memory devices to provide the processing

13   capability and data storage required to carry out the above-described functions.

14   The DIW network 20 includes a front end service 30 that allows a client 31 to generate

15   and submit a service or job request 32 (see Figure 7). In an embodiment, the front end service 30

16   may be an Internet web browser. Alternatively, the front end service 30 may be a web application

17   or a port monitor. The job request 32 may contain detailed information about how the job is to be

18   executed, and may be formatted according to the job definition format standard. Alternatively, the

19   job request 32 may include only basic information, which will be used by another component to

20   finalize the job definition, or work flow. Finally, the job request 32 may include the content, or job,

21   that is to be processed. The content could be one or more digital files, text files, and other files.

22   The front end service 30 is coupled to a communications network 35, which may be the Internet

23   or a local area network, for example. Coupled to the communications network 35 is a service

24   center 40 that links one or more processors 80_i to the communications network 35. Each of the

25   processors 80_i may include a cache 81_i that may be used to store information related to a job

26   request 32, including information related to job tickets. In an embodiment, the service center 40

27   may be an Internet web site that includes data storage and control functions. In another

28   embodiment, the service center 40 is a node in a local area network.

29   The service center 40 allows a broad spectrum of communications between entities coupled

30   to the service center 40. In particular, the service center 40 allows different e-services to interact

1   programmatically with one another using specific protocols and generic protocols (e.g., TCP/IP).

2   This programmatic interaction allows different services and processes that are coupled to the

3   network to exchange data and files, and to modify the data and files. The programmatic interaction

4   may be completed by use of a remote procedure call (RPC) between entities coupled to the service

5   center 40. Other methods for providing the programmatic interaction include CORBA, UDDI, and

6   e-speak.

7   Figure 4 is a diagram of the service center 40. The service center 40 includes a service bus

8   41 in communication with the communications network 35 and the processors 80_i of Figure 3.

9   Coupled to the service bus 41 is a job store 50, a job ticket service 60, a work flow controller 70,

10   an optional bidding service 90, an authorization server 92 and an authentication server 94. The job

11   store 50 may store one or more job content files 51_j. The job ticket service 60 may control one

12   or more job tickets 61_i. The work flow controller 70 may use one or more agents 71_i to control

13   processes on the service bus 41.

14   The job store 50, job ticket service 60 and work flow controller 70 function to accept

15   information from the clients 31, and to use the information to control the actions of the processors

16   80_i. The processors 80_i performs specific tasks or processes as determined by the service center

17   40.

18   The job store 50 may be a node on the service bus 41, and may include programming to

19   allow the job store 50 to carry out its functions. The job store 50 may be used to store the content

20   51, which may be in the form of one or more large files. In the context of printing a document using

21   a service or process coupled to the service bus 41, the job store 50 may store the document

22   content in one or more PDF files, for example. The content 51 may include graphics and text. The

23   content 51 for a specific document may include several files. For example, a brochure may have

24   a separate file for the cover and another file for the inside pages. Text for the inside pages may be

25   in one file and images in yet another file. The content 51 may also include links to other resources

26   or entities on the service bus 41. The job store 50 provides for mass storage of the content 51, so

27   that a user (client 31 or processor 80) does not have to provide the mass storage required for the

28   job content 51. By using the mass storage capabilities of the job store 50, the content 51 may be

29   made to persist in the network 20, and may be made accessible to users at any time. The job store

30   50 also manages and controls the content so that the user (client 31 or processor 80) does not have

1   to manage the content 51. Management functions include maintaining configuration or version

2   control of the content 51, controlling access to the content 51, and maintaining the content 51 in

3   storage.

4   The job ticket service 60 holds job tickets 61. The job ticket service 60 controls access

5   to and may manage configuration of the job tickets 61. For example, the job ticket service 60 may

6   allow users (clients 31 and processors 80) to access a portion or branch of a job ticket 61 rather

7   than passing the job ticket 61 among multiple users. Access to the job ticket portion may be

8   effectuated by use of an application programming interface, a scriptable interface, or a similar

9   feature. As noted above, the job ticket 61 does not include the content 51 (e.g., the graphical and

10   text files of a document), but the job ticket 61 relates to content 51 (e.g., a PDF file) stored in the

11   job store 50. The user does not have to manage storage of the job content or to know which job

12   store 50 holds the job content. The job ticket service 60 instead passes a reference in the job

13   ticket 61. This allows multiple clients 31 and processors 80, to access the content 51.

14   Furthermore, the content 51 may relate to more than one job ticket 61. The job ticket service 60,

15   and its interrelationships with other entities coupled to the service bus 41, will be described later

16   in detail.

17   Some job tickets 61 may be accessed by multiple processors 80, in either serial,

18   overlapping, or simultaneous fashion. The multiple access processing could result in problems with

19   use of the job ticket 61. For example, a first processor may acquire the job ticket 61 (or a portion

20   or branch thereof), and perform a process specified in the work flow, which may modify the

21   branch. Such modification may be to indicate a branch as complete, use up input resources, or

22   create new output resources, for example. A second processor could attempt to acquire the

23   branch, but might not "know" that the first processor had modified the branch. Alternatively, if two

24   processors compete for the same branch, a deadlock situation might occur.

25   One solution to the above problems may be to lock the job ticket 61 whenever a processor

26   80 acquires the job ticket 61. Unfortunately, locking the job ticket 61 may prevent concurrent or

27   parallel processing and may slow down completion of the job request 32.

28   The job ticket service 60 shown in Figure 4 overcomes these and other problems by having

29   the capability to lock the job ticket 61 at the branch level. The branch locking may be

30   accomplished by one of several methods. The work flow controller 70 may assign one or more

1   specific processors 80_i to perform the tasks identified with the branch to be locked. Where only

2   one processor 80 is authorized access to the branch, branch locking may not be required. Where

3   more than one processor 80 is authorized access to the same branch, the job ticket service 60 may

4   lock the branch when one of the authorized processors 80_i actually acquire the branch.

5   If the work flow controller 70 has not assigned processors 80_i to branches (i.e., any

6   processor 80 may access a branch at any time), the job ticket service 60 may lock the branch when

7   a processor 80 acquires the branch.

8   The job ticket service 60 may lock the branches by setting a lock/unlock flag for each

9   branch. Processors 80_i accessing the job ticket 61 may then review the lock/unlock flag status to

10 determine if the branch may be accessed. In some circumstances, the job ticket service 60 may

11 allow access only to those branches that are unlocked. A processor 80 that has completed a task

12 defined by the branch may need to have the branch unlocked in order to modify the branch.

13   The work flow controller 70 may be used to create the job tickets 61 that are stored in the

14 job ticket service 60. The work flow controller 70 may review the job requests 32 submitted by

15 the clients 31, and may then use a job ticket template to prepare the job ticket 61. The work flow

16 controller 70 may then send the job ticket 61 to the job ticket service 60 for storage and

17 processing.

18   The work flow controller 70 also controls completion of tasks among the processors 80_i.

19 In an embodiment, the work flow controller 70 determines which of the processors 80_i have the

20 necessary and available resources to begin the processes listed in a specific job ticket 61. The

21 work flow controller 70 then designates the appropriate processors 80_i to complete the tasks

22 referenced by the job ticket 61. For example, if a job ticket 61_1 requires color printing, the work

23 flow controller 70 may determine that only processor 80_3 is a color printer with the capacity to

24 begin the job specified in the job ticket 61_1. This embodiment in which the work flow controller

25 70 determines which processors 80_i to assign to a specific job ticket 61 may be especially

26 appropriate when the network 35 is a local area network and all processors 80_i are directly

27 coupled to the local area network 35.

28   Alternatively, the work flow controller 70 may receive bid information from Internet-

29 connected processors 80_i and may use the bid information to select the processors 80_i to complete

30 the job request 32.

1   The work flow controller 70 may also be used to designate the various nodes, input and

2   output resources, and other features of the node tree used to complete the job request. That is, the

3   work flow controller 70 may be used to create a construct, or work flow, such as the node tree

4   10 shown in Figure 2. To accomplish these tasks, the work flow controller 70 may include one or

5   more agents 71 that write a job definition file, based on control data contained in the job request

6   32. Alternatively, a separate management information system (not shown) may be used to create

7   the nodes, and to control flow of tasks to the processors 80_i and other entities. In yet another

8   embodiment, the job definitions may be written by the client 31 that originated the job request 32.

9   Referring again to the node tree 10 of Figure 2, many output resources of the individual

10   nodes serve as input resources for other nodes. These other nodes may not be able to begin

11   executing until all input resources are complete and available, which means that the nodes may need

12   to execute in a well-defined sequence. For example, a process for making plates will produce

13   press plates as an output resource that is required by a printing process. In the hierarchical

14   organization of the node tree 10, nodes that occur higher in the node tree 10 represent higher-level,

15   more abstract operations, while lower order nodes represent more detailed, specific processes.

16   Moreover, nodes near the top of the node tree 10 may represent only intent regarding the

17   components or assemblies that comprise the product, and lower level nodes provided the detailed

18   instructions to a processor 80 to perform a specific process.

19   Because two node trees may not be similar, the work flow controller 70 may determine

20   processes to be completed, the order in which the processes are completed, and the processors

21   80_i that are to complete the processes. The work flow controller 70 may use the agents 71 to

22   determine an actual work flow, considering factors such as control abilities of the processors 80_i

23   that complete the processes, transport distances between processors, load capabilities of the

24   processors 80_i, and time constrains in the job request, for example. The agents 71 may define the

25   overall process using serial processing, which involves subsequent production and consumption of

26   resources by the processors 80_i, overlapping processing, which involves simultaneous consumption

27   and production of resources by more than one processor 80, parallel processing, which involves

28   sharing resources among processors 80, and iterative processing, which involves a back and forth

29   processing scheme to develop resources.

1   In determining which of the processors 80₁ to assign to complete a particular job request,

2   the work flow controller 70 may poll processors 80₁ that are coupled to the service center 40. As

3   noted above, the processors 80₁ may be coupled directly to the service bus 41, or may be coupled

4   indirectly through another communications bus, such as the Internet, for example. The polling may

5   occur whenever a job ticket 61 is created by the job ticket service 60. Alternatively, the polling

6   and corresponding information collection may occur on a periodic basis, and the work flow

7   controller 70 may store information related to the processors 80.

8   As an alternative to polling, processors 80₁ coupled to the service center 80 may monitor

9   the job ticket service 60. The job ticket service 60 may periodically post, in a bulletin board

10   fashion, for example, notices for job tickets that are available for processing. The processors 80

11   may then submit a bid for the tasks and processes defined in the job ticket notice. The work flow

12   controller 70, or the separate, optional bidding service 90, may review the bids, and determine

13   which single processor 80 or combination of processors 80₁ would be best suited to complete the

14   tasks and processes defined in the job ticket notice.

15   The service center 40 may include several features to provide security and to control access

16   to the job ticket 61. As discussed above, the job ticket service 60 may include a provision for

17   branch locking. In addition, servers may be used to authorize and authenticate a processor 80 and

18   maintain the authorization and authentication during completion of a job request 32 (see Figure 7).

19   The authentication server 92 receives authentication information from a processor 80 and the

20   authorization server 94 uses the information to check authorization functionality. The authorization

21   or access rights of the processor 80 may be carried as a part of the job ticket 61. The servers 92

22   and 94 may be hardware devices, but need not exist in the same hardware platform, and the

23   servers 92 and 94 need not be tightly coupled. Alternatively, the functions of the servers 92 and

24   94 may be performed in programming stored in one of the components of the service center 40,

25   such as the work flow controller 70, for example. Using the above-described features, the service

26   center 40 may provide trusted authentication information about the processor 80 to the

27   authorization server 94, and the authorization server 94 then performs its authority check functions.

28   The job ticket 61 may be signed with an industry standard public key encryption message

29   digest (MD) signature, and may be protected by a public key encryption system. Hence, any user

30   that has the public key may validate the job ticket 61 without having to communicate with the

1   authentication server 92. These features reduce communication between distributed server

2   applications. The features also allow the job ticket 61 to be passed from one processor 80 to

3   another processor 80, maintaining security, without communicating with the service center 40.

4   In an alternative embodiment, the job ticket 61 holds authentication/access data, allowing

5   controlled access within the service center 40 infrastructure. Resources may be protected by

6   passwords and other mechanisms. Access to the job ticket 61 may be similarly protected.

7   Furthermore, processors 80_i with access authorization may have such access authorization invoked

8   by listing the processors in the job ticket. The listing may be effectuated by recording a network

9   address for the processors 80_i, for example. The network address may be incorporated in the bid

10   information recorded in the job ticket 61.

11   Although the above description refers to development by the work flow controller 70, other

12   components in the network 20 may be used to develop an overall work flow to complete the job

13   request 32. For example, the job ticket service 60 may be used to develop the overall work flow.

14   As discussed above, the bidding service 90 may be used to receive bid information from

15   processors 80_i coupled to the service center 40. The processors 80_i submit bids in response to

16   posting of job ticket notices at the service center 40. In an embodiment, the job ticket notice is a

17   separate object stored in the service center 40. In another embodiment, the job ticket 61 itself

18   serves the notice function. The work flow controller 70 may post the job ticket notices after receipt

19   of the job request 32. Whether the bidding service 90 or the work flow controller 70 receives the

20   bids, the bid evaluation and selection process may be the same.

21   The job ticket notice posted by the work flow controller 70 may include specific tasks or

22   processes (branches) that must be completed to complete the job request 32. A simple job request

23   32 may have only one branch. More complex job requests 32, such as the job request illustrated

24   in Figure 2 (i.e., print a brochure) may have many branches. Furthermore, some branches may be

25   so interrelated that they can only be completed in a specific sequence, while other branches can be

26   completed in a parallel or an overlapping fashion. This interrelationship may often be the result of

27   one branch producing an output resource that is an input resource for one or more other branches.

28   The job ticket notice may include descriptions of specific branches and their interrelationships in

29   sufficient detail to allow the processors 80_i to bid for completion of the branches. The job ticket

30   notice may persist in the service center 40 for a specified time to allow the processors 80_i to send

1   bids. The time may be a set value (e.g., one hour) or may be based on a completion deadline

2   specified in the job request 32.

3   The bidding service 90 may select bids 91 from the processors 80 based on set criteria.

4   For example, the job request 32 may specify minimum performance requirements (e.g., a maximum

5   cost and a completion deadline). The bidding service 90 may reject any bids that fail to satisfy the

6   minimum performance requirements. Where the work flow controller 70 has established multiple

7   branches, each such branch may include minimum performance requirements. The branch-specific

8   performance requirements may be established by the work flow controller 70 based on overall

9   performance requirements for the job ticket 61. A processor 80 that bids on a particular branch

10   may be rejected by the bidding service 90 if the processor 80 fails to meet the minimum

11   performance requirements.

12   If the client 31 does not specify any minimum performance requirements, the bidding

13   service 90 may apply a standard set of criteria (e.g., an industry standard). In addition, the bid

14   must satisfy any requirements for producing output resources. In this way, bids that are made in

15   error, or that would otherwise likely be rejected, can be screened out. For example, a bid for

16   printing inside pages of the brochure may indicate a one year completion date. Such a bid may be

17   rejected, even in the absence of any specified performance requirements from the client 31.

18   In addition to submitting performance requirements, the client 31 may specify an evaluation

19   algorithm for evaluating bids. For example, the client 31 may specify that cost is to be weighted

20   twice as much as any other performance requirement.

21   In the absence of a client-specified evaluation algorithm, the bidding service 90 may apply

22   a standard evaluation algorithm in order to rank bids for each branch in the work flow. The

23   evaluation algorithm may apply weighting criteria, or may apply a default rule. For example, bids

24   may be ranked based on a maximum score, where points are awarded for cost estimates below

25   a maximum and for completion times below a maximum. Once the evaluation algorithm has been

26   applied, the bidding service 90 ranks the bids for each branch. If only one processor 80 survives

27   the process, that processor 80 may be automatically selected and assigned to the branch. If

28   multiple processors 80_i survive, the bidding service 90 may provide a list of such processors 80_i

29   to the work flow controller 70, which will then select the processors 80 to be assigned to the

1   branches. Alternatively, the list may be provided to the client 31, and the client 31 may select the

2   processor(s) 80_i to complete the tasks defined in the work flow.

3   The work flow controller 70 may associate winning bids with corresponding branches, and

4   may store the bid information with the job ticket 61. The stored bid information may include

5   identification information that allows the authorization server 94 and the authentication server 92

6   to permit access to job ticket branches or to the entire job ticket 61. Because the bid information

7   is stored with the job ticket 61, a processor 80 may access those branches for which the processor

8   80 is authorized access without having to communicate directly with the job ticket service 61. This

9   feature allows the job ticket 60 to be passed from one processor 80 to another processor 80,

10   which improves processing time and efficiency.

11   In an embodiment, the work flow controller 70 accesses control data of the job ticket 61

12   to determine which processor(s) 80_i should be assigned to the specific task identified in the job

13   ticket. The work flow controller 70 may also identify which of the processors 80_i would be able

14   to meet the criteria specified in the control data, and may provide a list of such processors 80_i to

15   the client through the front end service 30. The client 31 may then select a processor(s) 80_i from

16   the list.

17   In an embodiment, the job ticket service may be embodied as a sequence of program

18   instructions stored on a computer-readable storage device, such as a CD-ROM, for example.

19   When loaded into, or coupled to a computer, the program instructions may be read and executed

20   by a processor of the computer to provide the functions of the job ticket service.

21   Figure 5A illustrates an exemplary job ticket 61. The job ticket 61 may include two parts.

22   A first part includes a framework 62 and an optional client extension 64. The framework 62

23   includes information, files and programming necessary to control tasks defined in the job ticket 61.

24   The client extension 64 may include information related to a specific client (machine) and to a user

25   of the machine. A second part includes a security module 67 that protects the job ticket 61 from

26   unauthorized access.

27   The framework 62 may include a job identification (ID) 63, a service ID 65, a task section

28   68, and a control data section 69. The job ID 63 includes a reference to a specific job, or content

29   51 that is stored in the job store 50. The job ID 63 also includes a reference to a particular job

30   store 50 that is used to store the content 51. An entity that acquires a reference to the job ticket

1   61 can use the job ID 63 to access the corresponding content 51. Thus, the network 20 shown

2   in Figure 3 may include multiple job stores 50, and the job ID 63 may be used to correlate the job

3   ticket 61 to a specific job store 50. The service ID 65 identifies a specific job ticket service 60 that

4   stores the job ticket 61. For example, the network 20 may include multiple job ticket services 60

5   (not shown in Figure 3). The service ID 65 is used to correlate the job ticket 61 to the appropriate

6   job ticket service 60.

7   The tasks section 68 (Figure 5B) may include branch definitions, and other information

8   needed to control completion of the branches. The tasks section 68 may be structured so that each

9   branch or node in a node tree is represented by one or more branches 66, in the tasks section. In

10   this embodiment, each node in the node tree (e.g., the node tree 10 of Figure 2) can have

11   associated with the node, the description 95, resources 96, lock/unlock flag 97, and security

12   functions 99. In this way, the job ticket 61 reflects a hierarchical database structure.

13   The control data section 69 includes the specific instructions, parameters, and criteria for

14   completing the task identified by the job ticket 61. Control data in the control data section 69 may

15   also be associated with each node in a node tree.

16   The security module 67 controls access to a specific job ticket. The security module 67

17   may be implemented using standard encryption and access techniques, including public/private key

18   infrastructures, for example. In an embodiment, the security module 67 may include a list of

19   authorized processors 80, that may be given access to one or more branches of the job ticket 61,

20   or to the entire job ticket 61.

21   The client extension 64 may contain "custom" information, such as user age, credit card

22   number and zip code. Information provided in the client extension 64 may be protected by use of

23   a public key signature, or similar feature. Hence, all client extension information will automatically

24   be included in a Message Digest Protocol (MDP) and will affect the signature of the job ticket 61.

25   With the above-describe job ticket architecture, many Internet-related security issues are

26   addressed, including IP spoofing, time controlled sessions, job ticket alterations, varying

27   authorization levels, and client-dependent persistent data storing.

28   The job ticket 61 shown in Figure 5A may be used to refer to a specific content 51 in the

29   job store 50. Alternatively, multiple job tickets 61 may be used to refer a specific content 51, or

30   one job ticket 61 may be used to refer to multiple contents 51. Thus, for example, one job ticket

1   61 may specify a repetitive printing task to be completed on similar documents, each of which has

2   a different content 51.

3   Using the network 20 shown in Figure 3, and the corresponding job ticket shown in Figure

4   5A, a client 31 may request and have completed many different electronic services. For example,

5   the client 31 may use the network 20 as an e-mail application.

6   Figure 5B shows the tasks section 68 in detail. The tasks section 68 may include one or

7   more branch descriptors 66 that include information related to processing for that branch. A

8   description segment 95 may define the tasks to be completed for each branch. Alternatively, the

9   description segment 95 may provide a link, or handle, to a file that contains the branch description.

10   The resources segment 96 lists input and output resources associated with the tasks defined for the

11   branch. The lock/unlock flag segment 97 allows a flag to be set to lock and unlock a branch. A

12   bid information segment 98 includes bid information gathered, for example, by the bidding service

13   90. The bid information 98 may include detailed information such as the IP address of the

14   processors authorized access to the branch, estimated performance information (e.g., estimated

15   cost, delivery time), and other information. Alternatively, the bid information 98 may contain a link

16   to another file containing the detailed bid information. The security segment 99 may indicate

17   authorized security levels, and may be used as part of a public key/private key infrastructure.

18   Figure 5C illustrates an embodiment of the control data 69. The control data 69 includes

19   a client address, which may be a machine address, such as an Internet protocol (IP) address. An

20   expiration date/time segment may be used to terminate active status of the ticket 61. Once

21   terminated, the ticket may be deleted from the job ticket service, and the corresponding content

22   51 may be de-referenced. That is, the content 51 may no longer be referenced by a specific job

23   ticket 61. This feature may help eliminate stale data, and free up resources for other job requests

24   32 (see Figure 7). Finally, the control data 69 may include specific performance requirements, such

25   as cost an delivery, warranty, required materials, price reductions based on quantity, and other

26   requirements, for example.

27   The use of job tickets as XML objects allows clients to define databases, and to store data

28   through the job ticket service 60 and the job store 50. The databases may be used to hold contact

29   lists, addresses, and other personal data. The databases may also be used to store any other

30   generic data. The databases could then be used in conjunction with a variety of e-services

1   provided by the processors 80₁. For example, an e-mail processor 80 that provides e-mail services

2   may be used in conjunction with a personal contact list to send e-mail messages, transfer electronic

3   files, or to establish a chat room. The e-mail processor 80 may access the contact list at predefined

4   intervals to send e-mail messages to a select group of e-mail addressees. Furthermore, because

5   the service center 40 provides a single portal to processors 80 that are coupled to the

6   communications network 35, the client 31 need not have any knowledge of the database structure,

7   or the processing requirements of the processors 80.

8   In the specific application of the generic XML database to an e-mail service, the client 31

9   may have established, as a generic database, a list of e-mail contacts. The contacts database may

10   then be stored in the job store 50 as a content file 51. A corresponding job ticket 61 may be

11   stored at the job ticket service 61. The job ticket 61 includes control data needed to send and

12   receive e-mail through the service center 40. Furthermore, the job ticket 61 serves as a pointer

13   to data in the content file 51. In particular, the job ticket 61 may store XML data that is related

14   to other data stored in the content file 51.

15   Alternatively, the job ticket 61 may store the contacts data. This alternative takes

16   advantage of the fact that the job ticket 61 includes a vocabulary that can be extended to include

17   the contact data, and that the vocabulary can be further extended to include properties for each

18   contact in the contact data. For example, the job ticket 61 may specify that a contact is a business

19   contact or a personal contact. Other properties may also be included, such as whether the contacts

20   in the contact database use mobile phones, land line phones, facsimile machines, and e-mail

21   addresses.

22   The use of the job ticket 61 also allows for parsing, searching and updating the contacts

23   database. For example, the client 31 may desire to search the contacts database for phone

24   numbers for all persons whose first name is Joe. This search functionality is included in the job

25   ticket 61, and allows the job ticket service 60 to provide the client with a list of phone numbers for

26   all entries in the contacts database where the person's first name is Joe. That is, the contacts

27   database includes entries having the property of Joe, and the job ticket service is able to search the

28   contacts database for this property, and to return a list of those entries to the client 31.

29   The properties function of the job ticket 61 also allows the job ticket service 60 to control

30   specific tasks desired by the client 31, or to indicate to the client that a desired task cannot be

1 completed. Staying with the example of the contacts database, the client 31 may desire to send

2 a facsimile transmission to all entries in the contact list that have a specific zip code. The job ticket

3 service 60 can search the contacts database by properties, looking for zip code. The job ticket

4 service 60 can also search the contacts database to determine if any entry does not have a facsimile

5 machine. For those entries that do not have a facsimile machine, the job ticket service 60 can

6 originate a message to send back to the client 31, informing the client 31 that the facsimile

7 transmission was undeliverable. Using this functionality, the client 31 need not know anything about

8 the intended recipients of the facsimile transmission.

9 Returning to the example of an e-mail service, at the client 31, an e-mail application may

10 be launched in order to send an e-mail message, using the Internet, to one or more contacts in the

11 contact database. However, the client 31 need not subscribe to any one Internet service provider.

12 Instead, the service center 40 determines which processor 80 best suits the client's needs for

13 sending the e-mail message. That is, the service center 40 may select a e-mail service provider (a

14 processor 80) to send the e-mail message to a chosen destination address. Furthermore, the

15 service center 40 may determine, based on information maintained in the contact database (i.e., the

16 content 51 in the job store 50), which delivery options are desired by a user at the destination

17 address. For example, the destination address user may desire that all e-mail messages be sent to

18 an e-mail box, or that an alert be provided whenever an e-mail message is sent. These delivery

19 features may be stored in the contact database. Alternatively, the delivery features may be stored

20 in a separate database (content file 51) in the job store 50, and the service center may retrieve

21 information form this separate database when determining how to deliver the e-mail message.

22 Specifically, the separate database may include a variety of users, along with the user's Internet

23 address. By comparing the Internet address provided with the out going e-mail to the Internet

24 addresses in the separate database, the service center 40 can determine desired delivery options

25 of the addressee. This process for determining delivery options is transparent to the client 31 that

26 originated the e-mail message. All that the client 31 need know is the contact information (e.g., the

27 Internet address).

28 The client 31 may use the job ticket service 60 to specify a number of performance features

29 related to the e-mail service. For example, the client 31 may want the service center to attempt a

1   specified number of delivery attempts, and if delivery does not occur, to send a return message to

2   the client 31 indicating non-delivery of the e-mail message.

3   As noted above, the job ticket 61, in conjunction with other components of the service

4   center 40, may also be used to create a persistent, generic object-based data structure, such as an

5   XML database. An example of the use of a job ticket 61 for this purpose is illustrated in Figure

6   5D. The job ticket 61 includes a contacts list 84, which may be in the form of an XML database,

7   or some other generic database. The contacts list 84 may include a structure with entries for

8   business 85 and personal 86 use. The business 85 and personal 86 contacts structures may include

9   entries of individuals 87, as shown. Each of the entries 87 may include specific properties, as

10   defined above. In addition, or alternatively, each of the entries 87 may include links to other

11   databases that provide additional information and properties about the individual.

12   While the use of the job ticket 61 as a XML database has been described with reference

13   to an e-mail and messaging service, the job ticket 61 is not so limited. Any data that is capable of

14   being stored in a database may be accesses and controlled using the job ticket 61.

15   The features described above, and shown in Figures 5A-5D, may be replicated in another

16   embodiment of a job ticket 61 in which all data related to a specific node or branch is located with

17   that node or branch. Using the example node-tree 10 shown in Figure 2, each node (branch) may

18   include detailed information and features such as resources, authorized processors 80_i, lock/unlock

19   flag, bid information, branch description, and other information.

20   Figure 6 is a diagram of functions of the job ticket service 60. The primary functions of the

21   job ticket service 60 are to store 73 the job tickets 61_i and to provide access 75 to the job tickets

22   61_i to users such as the client 31 and to the processors 80_i. To accomplish these storage and

23   access functions, the job ticket service 60 may create a job ticket reference 72 and a job resource

24   reference 74. The job ticket service 60 also controls job content access 76, updates 77 the job

25   tickets 61_i as processes are completed and reported by the processors 80_i, completes the job

26   tickets 61_i and reports 78 when all processes are completed for a specific job ticket 61, and

27   provides an approval process 79 to allow a client 31 to approve completion of the tasks designated

28   in the job ticket 61.

29   The job ticket reference 72 includes a specific reference to a corresponding job ticket 61_i.

30   The job ticket reference 72 may be used by the job ticket service 60 to allow one or processors

1   80_i and clients 31_i to access the job ticket 61. That is, instead of passing the job ticket 61 to a

2   processor 80, the job ticket service 60 passes the job ticket reference 72. With the job ticket

3   reference 72, the processor 80 may access all or a part of a job ticket 61 so that the processor 80

4   may complete one or more processes. Unlike conventional job ticket services, the job ticket

5   service 60 retains the job ticket in storage 73, and only permits users (clients 31_i and processors

6   80_j) to access the job ticket 61. This feature allows multiple processors 80 to simultaneously

7   complete processes for the specific job request 32 related to the job ticket 61.

8   The job ticket service 60 may also create a resources reference 74, and may provide the

9   resources reference 74 to the processors 80 and the clients 31 in a manner similar to that of the job

10   ticket reference 72. As noted above with the description accompanying Figure 2, the resources

11   may include physical devices and materials, and may include digital files. Use of the resources

12   reference 74 may simplify data included in the job ticket 61.

13   Alternatively, information contained in the resources reference 74 may be included in the

14   job ticket 61, or may be included in other files accessed by the clients 31_i and the processors 80_i.

15   Figure 7 is a diagram showing operation of selected functions of the job ticket service 60.

16   As shown in Figure 7, the job ticket service 60 includes a job ticket 61_1, which may be a

17   programming object such as that represented in Figure 2, and described above. The job ticket 61_1

18   is shown supplied to the job ticket service 60 by the client 31_1. The client 31_1 may be a networked

19   computer or similar device that is capable of transmitting the digital information representing the job

20   ticket 61_1 to the job ticket service 60. To ensure the job ticket 61_1 arrives at the job ticket service

21   60, the job ticket 61_1 may contain a reference to the job ticket service 60, such as the service ID

22   65 illustrated in Figure 5B. The service ID 65 may include a network address of the job ticket

23   service 60. For example, the service ID 65 may include a universal resource locator (URL) if the

24   job ticket service 60 is an Internet web site.

25   Also shown in Figure 7 are client 31_2 and processors $80_1 - 80_N$. The processors $80_1 - 80_N$

26   may include networked resources such as networked printers, electronic-commerce entities, such

27   as Internet web sites, and "brick and mortar" entities, such local print shops that are coupled to the

28   job ticket service 60 using the service bus 41.

29   The client 31 generates a job request 32 (content 51 and job ticket data). Using the front

30   end service 30 (not shown in Figure 7) and the service bus 41, the client 31_1 sends the job ticket

1   data to the job ticket service 60 and the content 51 (not shown in Figure 7) to the job store 50.

2   The job ticket service 60 may pass the job ticket data to the work flow controller 70, which will

3   create a job ticket 61. The content 51_1 and the job ticket 61_1 are related by the job ID 63. The

4   job ID 63 also includes an identification of the job store 50, and a location within the job store 50

5   in which the content 51_1 is stored. In an alternate embodiment, the content 51_1 may be stored at

6   the client 31_1, and may then be accessed by other users through the service bus 41 and the front

7   end service 30.

8   The job ticket 61_1 specifies processes that must be completed to finish the job request 32.

9   As noted above, Figure 2 illustrates processes required to print a brochure, including the inside

10   pages and the cover. More that one processor 80_1 may be required to complete such a job

11   request, or to complete the job request in the most cost-efficient and/or timely manner. The work

12   flow controller 70 (not shown in Figure 7) can determine which of the processors 80_1-80_N should

13   complete a specific process, and, if necessary, the order in which such processes should be

14   completed. The work flow controller 70 may poll the various processors 80_1 to determine which

15   may be used to complete the job request. The work flow controller 70 may then notify selected

16   processors 80_1 that a job request has been registered with the job ticket service 60.

17   For each job ticket 61_1 received, the job ticket service 60 creates a reference 72_1 to the

18   job ticket 61_1. The processor 80_1 may request access to the job ticket 61 in order to complete one

19   or more processes. In response, the job ticket service 60 provides the processor 80_1 with the job

20   ticket reference 72_1. The job ticket reference 72_1 is then used as an index to the job ticket 61_1.

21   The job ticket reference 72_1 may also be provided to other processors, such as the processor 80_2,

22   and to other clients, such as the client 31_2. The processor 80_2 and the client 31_2 may then access

23   the job ticket 61_1 at the same time as the processor 80_1 accesses the job ticket 61_1. This

24   simultaneous access allows different processes to be completed in parallel. In the example

25   illustrated in Figure 2, the processor 80_1 may complete some or all the processes for the inside

26   pages, and the processor 80_2 may complete the processes for the cover.

27   Figure 8 is a block diagram illustrating an example application of the control features of the

28   job ticket service 60. The job ticket 61_1 is referenced to the job content 51_1 by the job ticket ID

29   63, and information related to the job ticket 61_1 and the job content 51_1 is passed over the service

30   bus 41. The processors 80_1 can access the job content 51_1 and the job ticket 61_1 using the service

1 bus 41. In the illustrated example, the job ticket 61_1 refers to a job request 32 to print a brochure

2 using the processes outlined in Figure 2. The processor 80_1 is designated by the work flow

3 processor 70 to produce the inside pages of the brochure and the processor 80_2 is designated to

4 produce the brochure cover. The processor 80_1 passes a job ticket access request to the job

5 ticket service 60. The access request may include security information that allows the processor

6 80_1 to access the job ticket 61_1 and the corresponding content 51_1 or job. In response, the job

7 ticket service 60 provides a job ticket reference 62_1 that is used by the processor 80_1 to access

8 the job ticket 61_1. The processor 80_1 may use information in the job ticket 61_1 to access the

9 content 51_1 stored in the job store 50. Since the processor 80_1 will produce only the inside pages,

10 the processor 80_1 will not need access to all the information contained in the job ticket 61_1.

11 Furthermore, because the job ticket 61_1 remains in the job ticket service 60, other entities, such

12 as the processor 80_2, may continue to access the job ticket.

13 As the processor 80_1 completes various processes, the processor 80_1 may update the

14 content 51_1 and the job ticket 61_1. Thus, the job ticket 61_1 may reflect the latest status of the job

15 request 32. The status reports may indicate when a node in the node tree 10 is completed, when

16 an interim deadline is completed, when another processor may be used to complete a process, and

17 when all processing is complete. The status report may be included in a digital file that is used by

18 the work flow controller 70, for example. The status report may also be included in a human-

19 readable format, such as a pop-up window on a computer display screen. The processor 80_1 may

20 receive the job ticket reference 72_1, and may complete all scheduled processes, returning the job

21 ticket reference 72_1 to the job ticket service 60. The processor 80_1 may also send a copy of the

22 job ticket reference 72_1 to the processor 80_2, so that the processor 80_2 may access the job ticket

23 61_1, and the content 51_1 and produce the brochure cover.

24 Figure 9 is a flowchart illustrating an operation 100 of the job ticket service 60. The

25 operation 100 is based on completing the inside pages nodes shown in Figure 2. The operation

26 100 may be at least partly under the control of the work flow controller 70, or some equivalent

27 device. The operation 100 assumes that a job request 32 (job ticket data and content) have been

28 passed to the service center 40, and that a job ticket service 60 has been created. The operation

29 100 begins at start block 101. In review and assign processors block 105, the work flow

30 controller 70 determines which processors 80_i are able and available to complete the job. The

1   work flow controller 70, or the optional bidding service 90 may use polling or bidding features to

2   make the determination. If more than one processor 80_i is available, and can satisfy the

3   requirements of the job ticket 61, the work flow controller 70 may assign one specific processor

4   80 to the job. Alternatively, the work flow controller 70 may provide a list of processors 80_i to

5   the client 31, and allow the client 31 to select one or more processors 80_i.

6   In request job ticket block 110, a processor 80, having been authorized access to a job

7   ticket 61, sends an access request to the job ticket service 60 using the service bus 41. In block

8   115, the job ticket service verifies that the processor 80 may access the job ticket 61. Access may

9   be controlled by a password, an identification, and a public key/private key security system, for

10   example. In block 115, if the processor 80 is denied access, an error signal may be sent to the

11   processor and/or the client 31, block 120.

12   In block 115, if access is authorized, the job ticket service 60 provides the processor 80

13   with a copy of the job ticket reference 72 corresponding to the job ticket 61, block 125. The job

14   ticket reference 72 allows the processor 80 to access the job ticket at any time. By accessing the

15   job ticket 61 at any time, the processor 80 is able to view an updated version of the job ticket 61

16   as changes are made to the job ticket 61 by other entities, including other processors 80.

17   In block 130, the job store 50 provides access to the job content 51 that is referenced by

18   the job ticket 61. Only that part of the content 51 that may be needed by the processor 80 may

19   be supplied by the job store 50. For example, if the processor 80 is only to generate the inside

20   pages of the brochure, the job store 50 may not provide access to the content required to produce

21   the brochure cover. After receiving the job ticket reference 72 and the content 51, the processor

22   80 may perform one or more tasks using input resources to produce an interim or final output

23   resource. With completion of each node in the node tree 10, the processor 80 may provide an

24   input to the job ticket service 60 to allow modification of the job ticket 61, block 135. If the

25   processor 80 completes all required processes, the processor 80 may provide a final status report

26   to the job ticket service 60, block 140, along with any final modifications to the job ticket 61.

27   In block 145, the job ticket service 60 and the work flow controller 70 determine if any

28   additional tasking may be required. If additional tasks are required, the work flow controller 70

29   will ensure the appropriate processors 80 are assigned, and the operation returns to block 110.

30   If no additional processes are required, the operation moves to block 150 and ends.

1	Figure 10 is a flowchart illustrating the routine 105 for developing a work flow and assigning

2	processors to the work flow. The process starts in block 200. In block 205, the service center

3	40 receives a job request 32. The job request 32 may specify performance requirements,

4	resources, and other parameters, and may include content 51, or a link to the content 51. In block

5	210, the work flow controller 70 defines a work flow to accomplish the tasks specified in the job

6	request 32. The work flow may be represented by a node tree, such as the node tree 10 shown

7	in Figure 2.

8	In block 230, the work flow controller 70 generates a job ticket 61 using the information

9	provided by the job request 32, the work flow generated in block 210, and an appropriate job

10	ticket template. The job ticket 61 is then stored in the job ticket service 60. Any content 51 may

11	be stored in the job store 50.

12	The work flow controller 70 or the job ticket service 60 may create a job ticket notice, or

13	other object, and may post the notice, block 250, at the service center 40 so that outside entities

14	(e.g., the processors 80) may acquire sufficient information to bid on completion of the job ticket

15	61, or a branch 66 of the job ticket 61. In an alternative embodiment, the job ticket 61 may be

16	posted at the service center 40. If the job ticket 61 is posted, the job ticket 61 may include

17	mechanism to limit access to the job ticket or to limit access to certain portions of the job ticket 61.

18	For example, the client extension 64 may not be accessible to the processors 80.

19	In block 270, the service center 40 receives bids from specific processors 80 and in block

20	290, the service center 40 evaluates the bids. In block 295, the service center 40 determines if the

21	client 31 submitting the job request 32 intends to select the winning bid(s), or if the service center

22	40 makes the selection. If the client is to make the selections, in block 300, the service center 40

23	provides the bid information to the client 31. Then, in block 305, the service center 40 receives

24	the selections from the client 31. If the service center 40 is to make the selections, in block 310,

25	the service center 40 selects the winning bid(s). In block 315, the service center notifies the

26	winning processors. The service center may also store the bid information with the corresponding

27	job ticket 61. In block 320, the routine 105 ends.

28	Figure 11 is a flowchart illustrating the sub-routine 210 for defining a work flow. The sub-

29	routine 210 starts in block 350. In block 355, the work flow controller 70 determines if the work

30	flow will contain multiple branches. If the work flow will contain multiple branches, the work flow

1 controller 70 defines the branches, block 360. In block 365, the work flow controller 70 selects

2 a branch for which resources and processes are to be defined. In block 370, the work flow

3 controller 70 defines input resources for a first process, or node. In block 375, the work flow

4 controller 70 defines the tasks to be completed for the first process. In block 380, the work flow

5 controller 70 determines the output resources of the first process. In block 385, the work flow

6 controller 70 determines if another process is required for the work flow or branch. In no

7 additional processes are required, the work flow controller 70 determines if another branch is to

8 be defined, block 390. If another branch is to be defined, the work flow controller 70 selects

9 another branch, block 365, and the sub-routine 210 continues. If another branch is not to be

10 defined, the sub-routine ends 210, block 395. The results of the work flow definition may be

11 incorporated into the job ticket 61 (see Figure 10, block 230).

12 Figure 12 is a flow chart illustrating the sub-routine 250 of posting a job ticket notice or job

13 ticket. The sub-routine 250 starts in block 400. In block 405, the work flow controller 70

14 determines if the work flow associated with the job ticket 61 includes multiple branches. If the

15 work flow does not include multiple branches, the work flow controller posts the job ticket notice

16 listing the single branch, block 410. If the work flow includes multiple branches, the work flow

17 controller 70 posts the job ticket notice with multiple branches, block 420. The sub-routine 250

18 then ends.

19 Figure 13 is a flow chart illustrating the sub-routine 290 for evaluating bids. The sub-

20 routine starts in block 440. In block 445, the bidding service 90 selects a first bid for analysis. In

21 block 450, the bidding service 90 determines if the client 31 has supplied any evaluation criteria or

22 requirements. If the client has not supplied evaluation requirements, the bidding service 90

23 compares the selected bid to a set of standard, minimum performance requirements, which may be

24 industry-standard requirements block 455. In block 460, the bidding service 90 determines if the

25 bid meets the minimum performance requirements. If the bid does not meet the minimum

26 performance requirements, the bid is rejected, block 475. If the bid is rejected, the bidding service

27 90 determines if additional bids were submitted, block 495. If additional bids were submitted, the

28 bidding processor 90 returns to block 445 and selects the next bid for evaluation.

29 In block 450, if the client 31 has supplied performance requirements, the bidding service

30 90 compares the selected bid to the client-supplied performance requirements, block 465. In

1   block 470, the bidding service 90 determines if the selected bid meets the minimum criteria of the

2   client-supplied performance requirements. If the minimum criteria are not met, the bidding service

3   90 rejects the bid, block 475.

4   In blocks 470 and 460, if the minimum criteria are met, the bidding service 90 determines

5   if the client 31 has supplied an evaluation algorithm. If the client 31 has not supplied an evaluation

6   algorithm, the bidding service applies a standard evaluation algorithm, which may be an industry-

7   standard algorithm, block 485. If the client has supplied an evaluation algorithm, the bidding service

8   90 applies the client-supplied evaluation algorithm, block 490. The bidding service 90 may then

9   store the results of the algorithm pending evaluation of all bids.

10   In block 495, the bidding service 90 determines if any bids remain to be evaluated. If

11   additional bids remain, the sub-routine 290 returns to block 445, and the bidding service selects

12   the next bid for evaluation. In block 495, if no additional bids remain for evaluation, the bidding

13   service 90 ranks the bids, block 500. The sub-routine 290 then ends, block 505.

14   Figure 14 is a flowchart illustrating the routine 130 for providing access to a job ticket 61.

15   The routine 130 begins in block 510. In block 515, the job ticket service 60 receives a job ticket

16   reference 72 from a processor 80, and retrieves the corresponding job ticket 61, block 520.

17   In block 525, the job ticket service 60 compares the processor identification to processors

18   listed in the job ticket 61 or branches 66 of the job ticket 61. The job ticket service 60 determines

19   if the selected branches 66 are locked, block 530. If the selected branches 66 are not locked, the

20   job ticket service 60 copies the selected branches 66 to the processor 80, block 535. In block

21   550, the job ticket service 60 then determines if the selected branches 66 require locking. If the

22   selected branches do not require locking, the routine 130 ends, block 560. If the selected branches

23   66 require locking, the job ticket service 60 locks the selected branches 66, block 555. The

24   routine 130 then ends, block 560.

25   In block 530, if the selected branches 66 are locked, the job ticket service 60 determines

26   if the processor 80 intends to modify information in the selected branches 66, block 540. If the

27   processor 80 will not modify the selected branches 66, the job ticket service 60 may provide an

28   error message, block 545. If the selected branches 66 will be modified, the job ticket service 60

29   may unlock the selected branches 66.

1   Figure 15 is a flow diagram of a method for allowing access to a job ticket 61. The method

2   may execute as part of the routine 115 shown in Figure 9. The method starts with block 600. In

3   block 605, the authentication server 94 receives authentication information from a processor 80

4   and retrieves a job ticket 61 corresponding to a job ticket reference 72 possessed by the processor

5   80. At this stage of the process, the job ticket 61 (excluding the public key signature field 67)

6   contains two information fields, the framework 62 and the client extension 64. The framework 62

7   contains information such as the service ID, client IP address, expiration date and time, and

8   processor authorization, as previously described. The client extension 64 contains information such

9   as credit card number and zip code, also previously described. The information in the job ticket

10   61 (excluding the public key signature field 67) is then, for example, optionally hashed using, for

11   example, MD5 protocol, and encrypted with a public key encryption system, block 610, generating

12   a hash number, block 615. Other hashing or encryption techniques may also be used. The hash

13   number is representative of the specific information contained in the job ticket 61. The hash number

14   generated in block 615 is then encrypted using a standard public key encryption system, block 620.

15   Encrypting the hash number with a private key prevents any user without knowledge of the public

16   key from modifying the job information. In block 625, the job ticket 61 and the encrypted hash

17   number are concatenated to generate the completed job ticket 61. Hence, the completed job ticket

18   61 information fields: 1) the framework 62, 2) the client extension 64, and 3) the public key

19   signature (encrypted hash number) 67. The method then ends, block 630.

20   In the illustrated embodiments, the service center 40, and its sub-components, including the

21   work flow controller 70 and the job ticket service 60, for example, may be implemented as a single,

22   special purpose integrated circuit (e.g., an ASIC) having a main or central processor section for

23   overall, system-level control, and separate circuits dedicated to performing various different

24   computations, functions and other processes under control of the central processor section. Those

25   skilled in the art will appreciate that the service center 40 may also be implemented using a plurality

26   of separate, dedicated or programmable integrated or other electrical circuits or devices (e.g.,

27   hardwired electronic or logic circuits such as discrete element circuits, or programmable logic

28   devices such as PLDs, PLAs, or PALs). The service center 40 may also be implemented using

29   a suitably programmed general purpose computer, e.g., a microprocessor, microcontroller or other

30   processor device (CPU or MPU), either alone or in conjunction with one or more peripheral (e.g.,

1 integrated circuit) data and signal processing devices. In general, any device or assembly of

2 devices on which a finite state machine capable of implementing the flowcharts shown in Figures

3 9-15 can be used as the service center 40, or its sub-components.

4 The terms and descriptions used herein are set forth by way of illustration only and are not

5 meant as limitations. Those skilled in the art will recognize that many variations are possible within

6 the spirit and scope of the invention as defined in the following claims, and their equivalents, in

7 which all terms are to be understood in their broadest possible sense unless otherwise indicated.